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APPEAL BRIEF

Applicant	:	Lindfors, Sven
App. No	:	10/615,332
Filed	:	July 8, 2003
For	:	METHOD AND APPARATUS FOR THE PULSE-WISE SUPPLY OF A VAPORIZED LIQUID REACTANT
Examiner	:	Stouffer, Kelly M.
Art Unit	:	1792

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith for filing in the above-identified application are the following enclosures:

(X) Appeal Brief in 19 pages.

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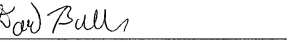

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APPEAL BRIEF

Applicant	:	Lindfors, Sven
App. No	:	10/615332
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In accordance with the Notice of Appeal filed November 10, 2008, Applicant submits this Appeal Brief.

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The real party in interest in the present application is ASM INTERNATIONAL N.V., the assignee of record.

II. RELATED APPEALS AND INTERFERENCES

Appellant does not know of any prior appeals, pending appeals, judicial proceedings, or interferences that may be related to, directly affect, be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 12-17, 19-26, and 30-34 are pending in this application, and are provided herewith in the Claims Appendix. Claims 1-11, 18, and 27-29 were canceled. Claims 12-17, 19-26, and 30-34 were finally rejected by the Examiner, and are the subject of this appeal. A copy of the appealed claims is attached as the Claims Appendix. No amendments were offered after final rejection.

IV. STATUS OF AMENDMENTS

No claims have been amended after the Final Office Action was sent on July 15, 2008.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present inventions relate generally to methods and structures for providing a vaporized reactant from a liquid source to a vapor deposition reactor, such as an atomic layer deposition (ALD) reactor. Each independent claim that is currently under consideration is summarized below, with reference to the originally-filed specification and drawings as required by 37 C.F.R. § 41.37(c)(1)(v). These citations are provided to enable the Board to more quickly determine where the claimed subject matter is supported in the application, and are not intended to limit the claims.

Independent Claim 12 is directed to a method for providing a vapor phase reactant from a solid or liquid source. Paragraph [0011]. The claimed method comprises supplying a liquid

comprising a precursor from a storage container to a vaporization chamber. *See* paragraphs [0011] and [0024]. The claimed method further comprises maintaining the vaporization chamber at a higher temperature than the storage container. *See* paragraphs [0011], [0022], and [0025]. The method further comprises vaporizing the precursor in the vaporization chamber. *See* paragraphs [0011], [0020], and [0025]. The method further comprises transporting the vaporized precursor to a reaction chamber. *See* paragraph [0011], [0020], [0021], and [0025]. The transporting comprises supplying pulses of the vaporized precursor to the reaction chamber alternatingly with pulses of at least one other precursor and stopping and allowing flow of the vaporized precursor from the vaporization chamber to the reaction chamber with an inert gas diffusion barrier and wherein stopping and allowing flow with an inert gas diffusion barrier comprises controlling valves for an inert gas flow outside of a hot zone accommodating the vaporization chamber. *See* Paragraphs [0028]-[0030]. The method further comprises conducting a vapor deposition process using the vaporized precursor in the reaction chamber. *See* paragraphs [0011] and [0026]. The method further comprises draining unvaporized liquid from the vaporization chamber after conducting the vapor deposition process without opening the vaporization chamber. *See* paragraph [0011]. The method further comprises returning the unvaporized liquid to the storage chamber. *See* paragraph [0026].

The Applicant has developed an improved method for providing a vapor phase reactant to a reaction chamber. *See* paragraphs [0016]-[0018]. The method is particularly useful for low vapor pressure reactants. *See* paragraphs [0016]-[0017]. The claimed methods offer numerous benefits over methods known in the art, including decreased reactor down time and maintenance, increased reactant stability, decreased likelihood of reactant decomposition, and decreased costs. *See* paragraphs [0016]-[0018].

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection presented for review is as follows.

(a) Claims 12-14, 19-23, 26, and 30 stand rejected as unpatentable over U.S. Patent No. 6,126,994 to Murakami et al. ("Murakami") in view of U.S. Patent No. 3,981,156 to Modisette et

al. ("Modisette") and further in view of U.S. Patent No. 7,063,981 to Bondestram et al. ("Bondestram").

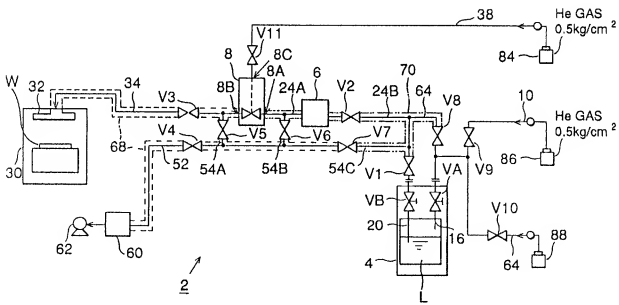
VII. ARGUMENT

1. Summary of the Teachings of Cited References

a. Summary of U.S. Patent 6,126,994 (Murakami)

Murakami teaches a method and apparatus for supplying a low vapor pressure liquid material. *See* abstract. Murakami describes one of the problems with the prior art as "liquid materials which have been once evaporated again liquefy and that residual liquid materials in pipes and connections react with oxygen and produce solid byproducts on replacement of liquid tanks loaded with the liquid materials, and the solid byproducts clog the pipes and connections." Col. 2, ll. 9-14.

Murakami discloses a liquid supply apparatus in FIG. 1, pictured below:



Murakami discloses a discharge passage 52. Murakami describes that "[o]n the discharge side of

the discharge passage 52 there are inserted a main shut-off valve V4, a cold trap 60 for removing liquid from the exhaust, and a vacuum pump 62 in the stated order. Col. 5, ll. 36-39. The cold trap is used to remove liquid from the exhaust line. Col. 5, lines 38-40.

Murakami is concerned with reactants clogging the piping of the liquid supply apparatus. *See* col. 7, ll. 54-58. Murakami merely discloses common connections and passages between the discharge passage 52 and the container 4. Within these common connections are line 20 and valve VB. These components are not used to return liquid to the container. The common passages serve another purpose, specifically, as stated at col. 5, lines 48-55, Murakami discloses that:

> In the present embodiment, considering a case that the residual liquid, etc. cannot be sufficiently drawn off by draw through the discharge passage 52, a purge (washing) liquid supply passage 64 is connected to the second pressure liquid supply passage 24B through a pressurization passage 10 which can be disconnected by a valve operation. Purge (washing) liquids can be alcohol, such as ethanol, methanol, etc., and organic solvents, such as hexane, etc.

Murakami discloses that valve VB is used to provide isolation during purge (washing). For example, Murakami also discloses at col. 7, line 62 to col.8, line 15:

> The liquid material is generally an organic metal material. The organic metal material is very reactive and is readily oxidized or solidified in contact with air, which cause clogging of the piping. Accordingly, it is very difficult to handle the mouth ring, etc. for connecting/disconnecting the reservoir which are readily exposed to air.
>
> First, the first and the second opening/closing valves VA, VB of the reservoir 4 in FIG. 1 are closed to place the reservoir out of communication. The first shut-off valve V1 of the second pressure liquid supply passage 24B is opened, the second shut-off valve V2 thereof being closed. The first and the second discharge shut-off valves V5, V6 of the branched passages 54A, 54B communicated with the discharge passage 52 are closed, the third discharge shut-off valve V7 of the branched passage 54C and the main opening/closing valve V4 being opened.
>
> Thus, residual liquid material on the mouth ring of the pipe of the reservoir 4, and that on the mouth ring for connection between the second pressure liquid supply passage 24B and the reservoir 4 is drawn and expelled through the discharge passage 52.

Murakami also describes one of the advantages of the system that "[b]ecause of the discharge passage, liquid material residue in the evaporator can be expelled before the start of a deposition." Col. 10, ll. 45-47.

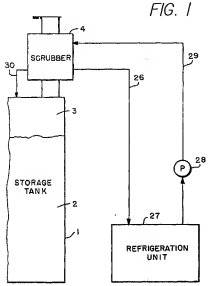
b. Summary of U.S. Patent 3,981,156 (Modisette)

Modissette teaches a vapor recovery system and method, the method includes "recovering vapors from exhausts or vents of containers of volatile substances comprising the steps of: providing a scrubber for connection to the vapor space of the container to receive a flow of vapors therefrom; providing a reservoir of absorber fluid; cooling the absorber fluid; introducing the cooled absorber fluid into the scrubber for intimate contact with the flow of vapors therethrough; and returning the vapors absorbed by the cooled absorber fluid to the container. Abstract.

Modisette is concerned with the handling of volatile substances in storage tanks, particularly fluid hydrocarbons. *See* col. 1, ll. 13-31. One of the goals of Modisette is to reduce problems with handling volatile liquids in storage tanks, for example, adding volatile liquids to storage tanks can cause elevated pressure in the tank. *Id.* Exhausting the tanks to the environment causes the loss of valuable material or additional pollution. Col. 1, ll. 26-31.

Modissette discloses a vapor recovery system comprising a scrubber where the scrubber condenses excess vapor and returns the liquid to the storage tank. *See* FIG. 1, col. 2, ll. 9-24.

FIG. 1



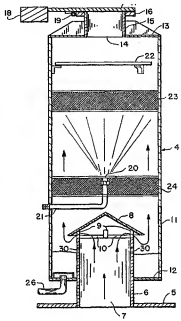


FIG. 2

The chiller absorber fluid flows through the nozzle 20 and contacts the vapors from the storage tank 1. *See* FIG. 2; col. 3, ll. 54-68; col. 4, ll. 19-28. The vapor from the storage tank is condensed in the scrubber and collected in the scrubber sump. *Id.* The collected fluid can be returned to the storage tank via the overflow return 30.

c. Summary of U.S. Patent 6,126,994 (Bondestram)

Bondestram teaches a method for supplying repeated pulses of vapor phase reactants to a reaction chamber. *See* col. 3, ll. 9-23. Bondestram also teaches a method for determining changes in the supply of repeated vapor phase reactant pulses from a reactants source within an atomic layer deposition (ALD) system. *See* col. 3, ll. 24-34.

2. Arguments Corresponding to the Grounds of Rejection

a. Claims 12-14, 19-23, 26, and 30 are patentable over the combined teachings of Murakami, Modisette, and Bondestram

Claims 12-14, 19-23, 26, and 30 stand rejected as being unpatentable over Murakami in view of Modisette and Bondestram. Independent Claim 12 is drawn to a method for providing

vapor phase reactant from a solid or liquid source. Claim 12 recites, in part, "returning the unvaporized liquid to the storage container; and returning the unvaporized liquid to the vaporization chamber."

The Examiner found that it was obvious to modify the methods and structure of Murakami to recover and reuse the valuable material in view of the general teaching in Modisette to recover vaporized fluid. In response to Applicant's arguments, the Examiner found that "there are no structural differences between that of Murakami and the invention as claimed; therefore they are capable of performing the invention." O.A. page 2. The Examiner further found that Modisette "gives motivation for using the valves and passages of Murakami in this manner, to recover and reuse valuable material." *Id.*

The Examiner further found that "Murakami et al. shows a discharge passage 52 that collects unvaporized liquid from the evaporator 8 and is connected to reservoir 4 in Figure 1. Though Murakami et al. does not explicitly disclose the unvaporized liquid flowing from discharge passage 52 into reservoir 4, one of ordinary skill in the art would recognize the utility of connecting a discharge passage from the evaporator into the reservoir, especially given valve VB and line 20, would be to drain unvaporized liquid back into the reservoir that would eventually travel back to the vaporizer." O.A. page 5. The Examiner also found that "Modisette et al. teaches that one would want to recover vapors in chemical processes and return them to a storage container to prevent the loss of valuable material". O.A. page 5. The Examiner further found that "Murakami et al. provides gas passageway 52 that would be used in a process such as the one taught by Modisette et al." O.A. page 5. The Examiner found Bondestram to teach an atomic layer deposition system with alternating pulses of two vaporized reactant sources. Appellant respectfully disagrees with the Examiner.

Appellant submits there is no reason in Murakami, Modisette, or the other cited references to modify or use the structure disclosed in Murakami in the method recited in Claim 12. Appellant further submit that the asserted combination is improper because Murakami teaches away from the combination.

To determine whether it would be obvious to combine the known features of Murakami, Modisette, and Bondestram as the Examiner suggests, a court should look to the interrelated teachings of these references, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741 (2007). Further, "As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (emphasis added).

This analysis should be made explicit, since obviousness rejections cannot be sustained by mere conclusory statements. *Id.* at 1740-41, citing with approval *In re Kahn*, 441 F.3d 977, 988 (78 U.S.P.Q.2d 1329, 1336) (Fed. Cir. 2006). Even if the Examiner establishes a *prima facie* case of obviousness, this may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471 (43 U.S.P.Q.2d 1362, 1365) (Fed. Cir. 1997). A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984), MPEP § 2143.03 VI.

Appellant respectfully asserts that the references teach away from the combination suggested by the Examiner. As discussed above, Murakami discloses a liquid supply apparatus. *See* FIG. 1. Murakami is concerned with reactants clogging the piping of the liquid supply apparatus. *See* col. 7, ll. 54-58. Murakami merely discloses common connections and passages between the passage 52 and the container 4. Within these common connections are line 20 and valve VB. These components are ***not*** used to return liquid to the container. Specifically, the common passages serve another purpose. Specifically, as stated at Col 5, lines 48-55, Murakami discloses that:

> In the present embodiment, considering a case that the residual liquid, etc. cannot be sufficiently drawn off by draw through the discharge passage 52, a purge (washing) liquid supply passage 64 is connected to the second pressure liquid supply passage 24B through a pressurization passage 10 which can be disconnected by a

valve operation. Purge (washing) liquids can be alcohol, such as ethanol, methanol, etc., and organic solvents, such as hexane, etc.

Consequently, valve VB is specifically used to provide isolation during purge (washing). The following passage further supports this:

> The liquid material is generally an organic metal material. The organic metal material is very reactive and is readily oxidized or solidified in contact with air, which cause clogging of the piping. Accordingly, it is very difficult to handle the mouth ring, etc. for connecting/disconnecting the reservoir which are readily exposed to air.
>
> First, the first and the second opening/closing valves VA, VB of the reservoir 4 in FIG. 1 are closed to place the reservoir out of communication. The first shut-off valve V1 of the second pressure liquid supply passage 24B is opened, the second shut-off valve V2 thereof being closed. The first and the second discharge shut-off valves V5, V6 of the branched passages 54A, 54B communicated with the discharge passage 52 are closed, the third discharge shut-off valve V7 of the branched passage 54C and the main opening/closing valve V4 being opened.
>
> Thus, ***residual liquid material on the mouth ring of the pipe of the reservoir 4, and that on the mouth ring for connection between the second pressure liquid supply passage 24B and the reservoir 4 is drawn and expelled through the discharge passage 52.*** A cold trap 60 and vacuum pump 62 are on the discharge side of the discharge passage. ***The cold trap 60 is used to remove liquid.*** The vacuum pump can be used to evacuate the piping. Murakami at Col. 7, line 62 to Col.8, line 15 (emphasis added)

Murakami therefore explicitly teaches that unused liquid is collected in the cold trap and exits the system via the discharge passage. *Id.*

Murakami does not teach returning reactants to the liquid reservoir 4. In fact, Murakami's focus on removing reactants (vapor and liquid) through the discharge passageway to prevent clogging and contamination caused by the reactants ***teaches away*** from returning the reactants to the liquid reservoir 4.

Neither Modisette nor Bondestram[1] make up for any of the above noted deficiencies of Murakami. Bondestram discloses an ALD process. As discussed above, Modisette teaches the use of a scrubber to condense vapor from a storage tank. The vapor recovery system is disclosed in the context of handling volatile substances, such as fluid hydrocarbons. *See* col. 1, ll. 13-25. The storage tanks are typically filled with hydrocarbons that may be mixed with ***air***. *Id.* The scrubber uses a chilled spray or absorber material sprayed out of a nozzle to contact the vapors from the storage tank. The vapors exiting the storage tank contact the chilled spray and the packing elements within the scrubber (presumably in the presence of air), causing vapor to be absorbed and/or condensed. *See* col. 4, ll. 19-28. The condensed fluids are collected at the bottom of the scrubber and recycled as chilled spray or returned to the storage container. *Id.*

As discussed above, Murakami is focused on avoiding contamination in the pipes by avoiding contact between residual reactants and oxygen in the ambient atmosphere. Modisette teaches that the recycled volatile substance (e.g. hydrocarbons) may also be mixed with ***air and then returned to the storage container***. Therefore, the combination does not work because this is the specific problem that Murakami is focused on avoiding. Accordingly, Modisette further teaches away from the combination suggested by the Examiner.

For the reasons discussed above, Appellant submits there is no reason in Murakami, Modisette, or the other cited references to modify or use the structure disclosed in Murakami to return the unvaporized liquid to the storage container or return the unvaporized liquid to the vaporization chamber, as recited in Claim 12. In considering whether a combination teaches the features of the claim the references must be considered as a whole for all that they teach or suggest. In this case, Murakami ***teaches away*** from such a modification or combination by disclosing "a cold trap 60 for removing liquid from exhaust." Col. 5, lines 38-40. Further, the focus of

[1] Applicant also notes that Bondestram is a reference under 35 U.S.C. § 102(e) only. Applicant reserves the right, if appropriate, at a future date to remove Bondestram as a reference by swearing behind and/or asserting co-ownership under 35 U.S.C. § 103(c). However, we do not need to remove Bondestram at this time in view of the arguments in the body of the appeal brief.

Murakami is to avoid contamination of the piping. Murakami is concerned with preventing condensation of the vaporized reactants and purging the system of all unvaporized liquid reactants to prevent decomposition of unvaporized reactants to form solids that clog the piping. *See* col. 2, ll. 9-15; col. 7, ll. 12-16; col. 7, line 67 to col. 8, line 18; col. 7, ll. 35-44; col. 9, ll. 14-21. Murakami is particularly concerned with the exposure of the liquid reactants to oxygen. *Id.* Modifying Murakami to return the remaining highly reactive reactants to the storage container 4 could cause contamination and undesirable clogging of the pipes, thereby frustrating the purpose of Murakami.

Based on the foregoing, Appellant respectfully submits that the interrelated teachings of the prior art, as well as the background knowledge possessed by an ordinarily skilled artisan, would actually suggest **against** modifying the structure and process disclosed in Murakami to return unvaporized liquid to the container as disclosed by Modisette. Therefore, Appellant respectfully asserts that the combination of Murakami, Modisette, and Bondestram is improper.

Appellant respectfully submits that the Examiner persists in combining the teachings of Murakami, Modisette, and Bondestram simply because such a combination would meet the currently pending claims. In short, it seems clear that the Examiner is drawing conclusions based on impermissible hindsight reasoning. A factfinder should be aware of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning. *KSR*, 127 S. Ct. 1727, 1741 (82 U.S.P.Q.2d at 1397) (2007). The Examiner's judgment on obviousness should consider only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made, and should not include knowledge gleaned only from Appellant's disclosure. *In re McLaughlin*, 443 F.2d 1392, 1395 (170 U.S.P.Q. 209, 212) (CCPA 1971). In the face of the teachings away in the art, and the lack of any reason given in Murakami to recover unvaporized liquid instead of purging the unvaporized liquid, an ordinarily skilled artisan would not have found it obvious to combine the teachings of Murakami, Modisette, and Bondestram as suggested by the Examiner.

Based on the foregoing, Appellant respectfully submit that Claims 12-14, 19-23, 26, and 30 are patentable over the combined teachings of Murakami, Modisette, and Bondestram, and respectfully request that the Board reverse the Examiner's rejection of these claims.

Appellant also respectfully assert that Claims 15-17, 24-25, are also 31-34 patentable because they depend from independent Claim 12 and recite additional features of utility.

Respectfully submitted,

KNOBBE MARTENS OLSON & BEAR LLP

Dated: December 9, 2008

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VIII. CLAIMS APPENDIX

Claim 12. A method for providing vapor phase reactant from solid or liquid source, comprising:

supplying a liquid comprising a precursor from a storage container to a vaporization chamber;

maintaining the vaporization chamber at a higher temperature than the storage container;

vaporizing the precursor in the vaporization chamber;

transporting the vaporized precursor to a reaction chamber;

conducting a vapor deposition process using the vaporized precursor in the reaction chamber;

draining unvaporized liquid from the vaporization chamber after conducting the vapor deposition process without opening the vaporization chamber;

returning the unvaporized liquid to the storage container; and

returning the unvaporized liquid to the vaporization chamber

wherein transporting comprises supplying pulses of the vaporized precursor to the reaction chamber alternatingly with pulses of at least one other precursor and stopping and allowing flow of the vaporized precursor from the vaporization chamber to the reaction chamber with an inert gas diffusion barrier and wherein stopping and allowing flow with an inert gas diffusion barrier comprises controlling valves for an inert gas flow outside of a hot zone accommodating the vaporization chamber.

Claim 13. The method of Claim 12, wherein the liquid is the precursor.

Claim 14. The method of Claim 13, wherein vaporizing comprises maintaining an unvaporized liquid in the vaporization chamber and generating vaporized precursor above the unvaporized liquid.

Claim 15. The method of Claim 12, wherein the liquid comprises a solid reactant source dissolved in a solvent.

Claim 16. The method of Claim 15, wherein vaporizing the precursor comprises vaporizing the solvent and vaporizing the solid reactant source.

Claim 17. The method of Claim 16, wherein draining comprises providing solvent to the vaporization chamber to dissolve remaining solid reactant source and draining a resultant solution.

Claim 19. The method of Claim 12, wherein draining further comprises employing a pump.

Claim 20. The method of 12, wherein draining comprises removing the unvaporized liquid to a dedicated drain container.

Claim 21. The method of Claim 12, wherein the storage container is kept at a temperature at which the precursor is stable.

Claim 22. The method of Claim 21, wherein the vaporization chamber is kept at a vaporization temperature below the boiling point of the precursor.

Claim 23. The method of Claim 22, wherein transporting comprises flowing the vaporized precursor along conduits maintained at or above the vaporization temperature.

Claim 24. The method of Claim 22, wherein the vaporization chamber is maintained within a first hot zone in intimate contact with a second hot zone accommodating the reaction chamber.

Claim 25. The method of Claim 24, wherein the first hot zone and the second hot zone share at least some insulating elements.

Claim 26. The method of Claim 22, wherein the vaporization chamber and the reaction chamber are maintained within a single hot zone.

Claim 30. The method of Claim 12, wherein the vapor deposition comprises atomic layer deposition.

Claim 31. The method of Claim 12, wherein draining is conducted at regular intervals between a predetermined number of depositions.

Claim 32. The method of Claim 12, wherein draining is conducted regularly between deposition runs after a predetermined period of time.

Claim 33. The method of Claim 12, further comprising periodically refilling the vaporization chamber with liquid from the storage container.

Claim 34. The method of Claim 33, wherein periodically refilling comprises sensing a surface level of unvaporized liquid in the vaporization chamber has fallen below a predetermined level.

IX. EVIDENCE APPENDIX

None

X. RELATED PROCEEDINGS APPENDIX

None

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